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CLAIMS

[Claim(s)]

[Claim 1] The sheet mold electrochemistry component characterize by apply acid denaturation polyolefine to a closure part with said sheathing object of both sides of the terminal for external connection which the inner surface of said sheathing object is polyolefine , and has be connect to said electrode in the sheet mold electrochemistry component which comes to seal the electrode and the electrolyte structure which arranged the electrode on the both sides of a solid polymer electrolyte to the sheathing inside of the body .

[Claim 2] The sheet mold electrochemistry component according to claim 1 which the breakthrough is formed in the closure part with said sheathing object of both sides of said terminal for external connection, and comes to carry out said sheathing inside-of-the-body side and the terminal for external connection concerned thermal melting arrival in the part concerned.

[Claim 3] The terminal for external connection is connected to said electrode of the electrode and the electrolyte structure which arranged the electrode on the both sides of a solid polymer electrolyte. While acid denaturation polyolefine is applied to the closure part with the sheathing object of both sides of this terminal for external connection and an inner surface encloses said electrode and electrolyte structure with the sheathing inside of the body of polyolefine The manufacture approach of the sheet mold electrochemistry component characterized by carrying out thermal melting arrival of said sheathing inside-of-the-body side and said terminal for external connection.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the sheet mold electrochemistry component which started a sheet mold electrochemistry component and its manufacture approaches, such as a sheet mold cell and an electric duplex layer capacitor, especially devised the configuration of the terminal for external connection, and its circumference part, and its manufacture approach.

[0002]

[Description of the Prior Art] In recent years, the activity or the activity is considered for the rechargeable battery which used a carbon material, oxidation tin, silicon oxide, etc. for the negative-electrode active material called a lithium ion rechargeable battery in

various electronics products and an electric vehicle. The so-called electrolytic solution made to dissolve an electrolyte salt in the solvent of a liquid is used for these lithium ion rechargeable batteries. Although there is the advantage in which the cell using the electrolytic solution has low internal resistance, on the other hand, there is a trouble which a liquid spill tends to carry out that there is a danger of igniting. As opposed to such a trouble, the gel solid polymer electrolyte which consists of a macromolecule, an electrolyte salt, and a solvent is in the limelight in recent years. As for such a gel solid polymer electrolyte, conductivity has some which will show the value of $\sim 10^{-3}$ S-cm soon in it of a liquid.

[0003] Since the electrolyte of a liquid is not used for the cell using a solid polymer electrolyte, a liquid spill cannot carry out it easily. Therefore, it is not necessary to close whether it is mechanical like the conventional cell using the electrolytic solution of a liquid by the metal container and packing made from a macromolecule which occurs between them. A liquid spill can be prevented with extent which makes sheathing (container) the laminate film with which a solid polymer electrolyte cell consists of a high polymer film and a metallic foil.

[0004]

[Problem(s) to be Solved by the Invention] However, the adhesion of the terminal for external connection and laminate film which were connected to the electrode of a cell depending on the class of macromolecule which forms the laminate film as sheathing was inadequate, and immobilization of the terminal for external connection was not enough.

[0005] In addition, although a laminate film can be used as sheathing also in the electric duplex layer capacitor using a solid polymer electrolyte etc., the same problem occurs.

[0006] In order to improve the above-mentioned fault, this invention persons The cell using this kind of solid polymer electrolyte as a result of examining various macromolecules, The inner surface of the laminate film which can be used as a sheathing object of sheet mold electrochemistry components, such as an electric duplex layer capacitor, is polyolefine. Since the sheet mold electrochemistry component using the terminal for external connection with which acid denaturation polyolefine is applied was excellent in the adhesion of a laminate film and the terminal for external connection, it found out that the fixed reinforcement of the terminal for external connection was large enough.

[0007] In addition, although what uses a two-layer resin film besides a laminate film is proposed as a sheathing object in JP,8-287889,A, fixing reinforcement of the terminal for external connection is not improved.

[0008] This invention aims at offering the sheet mold electrochemistry component which aimed at improvement of fixing reinforcement to the sheathing object of the terminal for external connection, and its manufacture approach in view of the above-mentioned point.

[0009] Other objects and new descriptions of this invention are clarified in the gestalt of the below-mentioned operation.

[0010]

[Means for Solving the Problem] in order to attain the above-mentioned object, in the configuration which closed the electrode and the electrolyte structure which arranged the electrode on the both sides of a solid polymer electrolyte to the sheathing inside of the body, the inner surface of said sheathing object be polyolefine, and the sheet mold electrochemistry component of this invention be carry out the description of acid

denaturation polyolefine be apply to a closure part with said sheathing object of both sides of the terminal for external connection linked to said electrode .

[0011] In said sheet mold electrochemistry component, the breakthrough is formed in the closure part with said sheathing object of both sides of said terminal for external connection, and it is good also as a configuration which carries out thermal melting arrival of said sheathing inside-of-the-body side and the terminal for external connection concerned in the part concerned.

[0012] The manufacture approach of the sheet mold electrochemistry component of this invention The terminal for external connection is connected to said electrode of the electrode and the electrolyte structure which arranged the electrode on the both sides of a solid polymer electrolyte. While acid denaturation polyolefine is applied to the closure part with the sheathing object of both sides of this terminal for external connection and an inner surface encloses said electrode and electrolyte structure with the sheathing inside of the body of polyolefine, it is characterized by carrying out thermal melting arrival of said sheathing inside-of-the-body side and said terminal for external connection.

[0013]

[Embodiment of the Invention] Hereafter, the gestalt of operation of the sheet mold electrochemistry component concerning this invention and its manufacture approach is explained according to a drawing.

[0014] Drawing 1 thru/or drawing 4 explain the gestalt of operation of this invention.

Drawing 1 is the important section expanded sectional view of the sheet mold lithium ion rechargeable battery as an electrochemistry component, drawing 2 is the forward sectional view of the whole configuration of a sheet mold lithium ion rechargeable battery, and it is drawing 1 which expanded the A section. Drawing 3 is this top view and drawing 4 is the top view of a charge collector. In these drawings, 1 is the separator of the solid polymer electrolyte with which it is intervened between negative electrodes by a positive electrode and 2, and 3 intervenes between forward and a negative electrode, and the charge collector 4 made from aluminum is carried out at a positive electrode 1, the laminating unification of the copper charge collector 5 is carried out at a negative electrode 2, respectively, and it constitutes the cell element assembly 10 (an electrode and electrolyte structure). As shown in drawing 4 , charge collectors 4 and 5 have the tongue-shaped piece sections 4a and 5a, in order to connect the terminals 7 and 8 for external connection, and the terminals 7 and 8 for external connection are welded here, respectively. It is desirable that a charge collector 4 and the terminal 7 for external connection welded to this are the metal construction material (or construction material which is easy to weld) with same charge collector 5 and terminal 8 for external connection similarly with the same metal construction material (or construction material which is easy to weld).

[0015] The sheathing object (hermetic container) 6 is the lamination bag of metallic foil 6a, such as aluminium foil, polyolefine (polypropylene etc.) film 6b of this inside, and insulating film 6c, such as a polyamide of a metallic foil outside, and polyester, and the inner surface has become polyolefine film 6b. Moreover, the acid denaturation polyolefines (acid denaturation polypropylene etc.) 9 are applied to the closure part with the sheathing object 6 of both sides of said terminals 7 and 8 for external connection. And said cell element assembly 10 with which the terminals 7 and 8 for external connection were welded is contained in the sheathing object 6 of the lamination bag which made

polyolefine the inner surface, and is closed by heating and pressurizing opening (slash section of drawing 3) of the sheathing object 6 as a condition which drew the point of the terminals 7 and 8 for external connection outside (thermal melting arrival is carried out).

[0016] The acid denaturation polypropylene which is a kind of said acid denaturation polyolefine is sold from Mitsui Chemicals, Inc. as a trade name "a uni-urinal stall (liquefied polyolefine system adhesives)." Since acid denaturation polyolefine has a carboxyl group in a molecule, its adhesion is good to metals (aluminum, copper, iron, stainless steel, etc.), polyolefine, etc. Moreover, thermal resistance is also excellent. Spreading of the acid denaturation polyolefine 9 to said terminals 7 and 8 for external connection should just spray the dispersion which made toluene etc. distribute acid denaturation polyolefine by a spray etc. on the need part (closure part with a sheathing object) of the terminal concerned.

[0017] According to the gestalt of this operation, the inner surface of the sheathing object 6 is polyolefine, and by having arranged the acid denaturation polyolefine 9 between the polyolefine of a parenthesis, and the terminals 7 and 8 for external connection, since this is excellent in the adhesion to the sheathing object 6 and terminals 7 and 8, immobilization of terminals 7 and 8 can be made into the reinforcement which is equal to practical use enough, and improvement in tensile strength can be aimed at.

[0018]

[Example] Hereafter, the example of this invention is explained to a detail by the case where a sheet mold lithium ion rechargeable battery is constituted.

[0019] As acid denaturation polypropylene which is a kind of [example 1] acid denaturation polyolefine, Mitsui Chemicals, Inc. "the uni-urinal stall R-200" was used. The uni-urinal stall R-200 is the dispersion which made toluene distribute an acid denaturation polypropylene particle. The uni-urinal stall R-200 was applied to aluminium foil with **** of 4mm, a die length [of about 40mm], and a thickness of 0.1mm, and a nickel foil by the spray. It put into the 200-degree C dry warehouse for 10 minutes, and was made to stick to it after spreading. These foils serve as the terminals 7 and 8 for external connection.

[0020] As for the electrode, the positive electrode 1 created an active material LiCoO_2 , electric conduction assistant carbon black (HS-100, DENKI KAGAKU KOGYO make), and the thing which it becomes from Binder PVDF (polyvinylidene fluoride) with the doctor blade method. The negative electrode 2 created an active material meso carbon micro bead (MCMB), electric conduction assistant HS-100, and the thing that consists of a binder PVDF with the doctor blade method. The separator 3 created PVDF and the thing which consists of SiO_2 with the doctor blade method. The positive electrode and the negative electrode were cut 31mm wide and in the shape of [41mm long] a rectangle. The separator was cut 33mm wide and in the shape of [43mm long] a rectangle. By 29mm wide like drawing 4 , and the shape of a 39mm long rectangle, further, it left charge collectors 4 and 5 (the ethylene acrylic-acid copolymer and the constituent of carbon black are applied to the EKUSUPANDO metal of the product made from aluminum, and copper) to tongue-shaped [with a width of face / of 7mm /, and a die length of 8mm], and they cut the terminal strapping part.

[0021] Creation of the cell element assembly 10 was performed as follows. The laminating of the separator 3 was first carried out to the positive electrode 1, and it laminated with a heat press. Lamination conditions are 130 degrees C and were

pressurized for 2 minutes by pressure 3kgcm-2. The laminating of the negative electrode was carried out to this, and it laminated similarly. The laminating of the charge collector 4 made from aluminum was carried out to the positive electrode of this, and it laminated similarly. In the negative electrode 2, the copper charge collector 5 was laminated similarly.

[0022] The terminal 8 made from nickel was welded by resistance to the terminal 7 made from aluminum, and the copper charge collector 5 at the charge collector 4 made from aluminum of this cell element assembly 10. LiPF₆ was immersed in the mixed solvent of the volume ratio 1:2 of EC (ethylene carbonate) and DMC (dimethyl carbonate) in this for 1 hour into 330ml of 1 electrolytic solutions in which it was made to dissolve M times. After picking out a cell element assembly from the electrolytic solution, the electrolytic solution adhering to an electrode surface was wiped off. This cell element assembly would absorb the electrolytic solution, and would be in the gel state. This cell element assembly was inserted in the sheathing object 6 (aluminium foil, a polypropylene film, and lamination bag with polyethylene terephthalate) which is inner surface polypropylene, opening was heat sealed (thermal melting arrival), and the sheet mold lithium ion rechargeable battery was produced. The cell of an example 1 using the terminal which applied acid denaturation polypropylene to the terminals 7 and 8 for external connection as acid denaturation polyolefine 9 was excellent in the tensile strength of the terminals 7 and 8 for external connection, as shown in the following table 1.

[0023]

table 1 A sample A terminal Tensile strength (kgf) An example 1 Aluminum 3.1 ** ** 3.2 ** ** 3.0 ** Nickel 13.0 ** ** 11.5** ** 10.2 An example 2 Aluminum 3.5 ** ** 4.0 **** 4.5 ** nickel 14.0 ** ** 14.5 **** 15.0 The example 1 of a comparison Aluminum 1.3 ** ** 1.7 ** ** 1.0 ** nickel 1.4 ** ** 2.3 ** ** 1.7

[0024] The sheet mold lithium ion rechargeable battery was produced like the example 1 except having used for the closure part with a sheathing object the terminals 7 and 8 for external connection which formed many small breakthroughs 11 like [example 2] drawing 6 . The sectional view was shown in drawing 5 , and the same sign was given to the same as that of an example 1, or a considerable part. The cell of an example 2 was excellent in tensile strength, as shown in said table 1. This reason is considered that the polypropylene of a sheathing inside-of-the-body side is from pile **** by the breakthrough 11 when thermal melting arrival of the sheathing object 6 and the terminals 7 and 8 for external connection is carried out.

[0025] The sheet mold lithium ion rechargeable battery was produced like the example 1 except having used the terminal for external connection which does not apply the [example 1 of comparison] acid denaturation polyolefine. As shown in said table 1, compared with the example 1, tensile strength is inferior in the cell of the example 1 of a comparison.

[0026] In addition, also in the case of sheet mold electrochemistry components, such as an electric duplex layer capacitor, this invention is applicable although the case where a cell was constituted as an electrode and the electrolyte structure was illustrated in the gestalt and example of the above-mentioned implementation. What is necessary is just to use a positive electrode and the polarizable electrode which used activated carbon etc. as active materials instead of the negative electrode in an electric duplex layer capacitor.

[0027] Moreover, acid denaturation polyolefine has some which are sold as liquefied

polyolefine system adhesives by the trade name "SEPORUJON", "ZAIKUSEN", and a "CSM latex" from the trade name "the AKUA tex" and Sumitomo Seika Chemicals Co., Ltd. other than the trade name "a uni-urinal stall" of Mitsui Chemicals, Inc., and these activities are also more possible for it than CHUO RIKI KOGYO Corp.

[0028] Although the gestalt of operation of this invention has been explained above, probably, as for this invention, it will be obvious to this contractor for various kinds of deformation and modification to be possible within the limits of the publication of a claim, without being limited to this.

[0029]

[Effect of the Invention] The inner surface of a sheathing object is polyolefine, as having explained above, the adhesion of a sheathing object and the terminal for external connection can improve, improvement in the fixing reinforcement of the terminal for external connection can aim at by having applied acid denaturation polyolefine to the terminal for external connection so that acid denaturation polyolefine may intervene between the polyolefine of a parenthesis, and the terminal for external connection, and, according to this invention, immobilization of the terminal for external connection serves as the reinforcement which is equal to practical use enough.

[0030] Moreover, the breakthrough is prepared in said some of terminals for external connection, the polyolefine of a sheathing inside-of-the-body side improves to the configuration which carries out thermal melting arrival of a sheathing object and the terminal for external connection in the part of this breakthrough, then a breakthrough, and the fixing reinforcement of the terminal for external connection improves to a pile lump pan.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the sheet mold electrochemistry component which started a sheet mold electrochemistry component and its manufacture approaches, such as a sheet mold cell and an electric duplex layer capacitor, especially devised the configuration of the terminal for external connection, and its circumference part, and its manufacture approach.

PRIOR ART

[Description of the Prior Art] In recent years, the activity or the activity is considered for the rechargeable battery which used a carbon material, oxidation tin, silicon oxide, etc. for the negative-electrode active material called a lithium ion rechargeable battery in various electronics products and an electric vehicle. The so-called electrolytic solution made to dissolve an electrolyte salt in the solvent of a liquid is used for these lithium ion rechargeable batteries. Although there is the advantage in which the cell using the electrolytic solution has low internal resistance, on the other hand, there is a trouble which a liquid spill tends to carry out that there is a danger of igniting. As opposed to such a trouble, the gel solid polymer electrolyte which consists of a macromolecule, an electrolyte salt, and a solvent is in the limelight in recent years. As for such a gel solid polymer electrolyte, conductivity has some which will show the value of $-one\ 10^{-3}\ S\text{-cm}$

soon in it of a liquid.

[0003] Since the electrolyte of a liquid is not used for the cell using a solid polymer electrolyte, a liquid spill cannot carry out it easily. Therefore, it is not necessary to close whether it is mechanical like the conventional cell using the electrolytic solution of a liquid by the metal container and packing made from a macromolecule which occurs between them. A liquid spill can be prevented with extent which makes sheathing (container) the laminate film with which a solid polymer electrolyte cell consists of a high polymer film and a metallic foil.

[Effect of the Invention] The inner surface of a sheathing object is polyolefine, as having explained above, the adhesion of a sheathing object and the terminal for external connection can improve, improvement in the fixing reinforcement of the terminal for external connection can aim at by having applied acid denaturation polyolefine to the terminal for external connection so that acid denaturation polyolefine may intervene between the polyolefine of a parenthesis, and the terminal for external connection, and, according to this invention, immobilization of the terminal for external connection serves as the reinforcement which is equal to practical use enough.

[0030] Moreover, the breakthrough is prepared in said some of terminals for external connection, the polyolefine of a sheathing inside-of-the-body side improves to the configuration which carries out thermal melting arrival of a sheathing object and the terminal for external connection in the part of this breakthrough, then a breakthrough, and the fixing reinforcement of the terminal for external connection improves to a pile lump pan.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the adhesion of the terminal for external connection and laminate film which were connected to the electrode of a cell depending on the class of macromolecule which forms the laminate film as sheathing was inadequate, and immobilization of the terminal for external connection was not enough.

[0005] In addition, although a laminate film can be used as sheathing also in the electric duplex layer capacitor using a solid polymer electrolyte etc., the same problem occurs.

[0006] In order to improve the above-mentioned fault, this invention persons The cell using this kind of solid polymer electrolyte as a result of examining various macromolecules, The inner surface of the laminate film which can be used as a sheathing object of sheet mold electrochemistry components, such as an electric duplex layer capacitor, is polyolefine. Since the sheet mold electrochemistry component using the terminal for external connection with which acid denaturation polyolefine is applied was excellent in the adhesion of a laminate film and the terminal for external connection, it found out that the fixed reinforcement of the terminal for external connection was large enough.

[0007] In addition, although what uses a two-layer resin film besides a laminate film is proposed as a sheathing object in JP,8-287889,A, fixing reinforcement of the terminal for external connection is not improved.

[0008] This invention aims at offering the sheet mold electrochemistry component which aimed at improvement of fixing reinforcement to the sheathing object of the terminal for external connection, and its manufacture approach in view of the above-mentioned point.

[0009] Other objects and new descriptions of this invention are clarified in the gestalt of the below-mentioned operation.

MEANS

[Means for Solving the Problem] in order to attain the above-mentioned object, in the configuration which closed the electrode and the electrolyte structure which arranged the electrode on the both sides of a solid polymer electrolyte to the sheathing inside of the body, the inner surface of said sheathing object be polyolefine, and the sheet mold electrochemistry component of this invention be carry out the description of acid denaturation polyolefine be apply to a closure part with said sheathing object of both sides of the terminal for external connection linked to said electrode.

[0011] In said sheet mold electrochemistry component, the breakthrough is formed in the closure part with said sheathing object of both sides of said terminal for external connection, and it is good also as a configuration which carries out thermal melting arrival of said sheathing inside-of-the-body side and the terminal for external connection concerned in the part concerned.

[0012] The manufacture approach of the sheet mold electrochemistry component of this invention The terminal for external connection is connected to said electrode of the electrode and the electrolyte structure which arranged the electrode on the both sides of a solid polymer electrolyte. While acid denaturation polyolefine is applied to the closure part with the sheathing object of both sides of this terminal for external connection and an inner surface encloses said electrode and electrolyte structure with the sheathing inside of the body of polyolefine, it is characterized by carrying out thermal melting arrival of said sheathing inside-of-the-body side and said terminal for external connection.

[0013]

[Embodiment of the Invention] Hereafter, the gestalt of operation of the sheet mold electrochemistry component concerning this invention and its manufacture approach is explained according to a drawing.

[0014] Drawing 1 thru/or drawing 4 explain the gestalt of operation of this invention. Drawing 1 is the important section expanded sectional view of the sheet mold lithium ion rechargeable battery as an electrochemistry component, drawing 2 is the forward sectional view of the whole configuration of a sheet mold lithium ion rechargeable battery, and it is drawing 1 which expanded the A section. Drawing 3 is this top view and drawing 4 is the top view of a charge collector. In these drawings, 1 is the separator of the solid polymer electrolyte with which it is intervened between negative electrodes by a positive electrode and 2, and 3 intervenes between forward and a negative electrode, and the charge collector 4 made from aluminum is carried out at a positive electrode 1, the laminating unification of the copper charge collector 5 is carried out at a negative electrode 2, respectively, and it constitutes the cell element assembly 10 (an electrode and electrolyte structure). As shown in drawing 4, charge collectors 4 and 5 have the tongue-shaped piece sections 4a and 5a, in order to connect the terminals 7 and 8 for external connection, and the terminals 7 and 8 for external connection are welded here, respectively. It is desirable that a charge collector 4 and the terminal 7 for external connection welded to this are the metal construction material (or construction material which is easy to weld) with same charge collector 5 and terminal 8 for external

connection similarly with the same metal construction material (or construction material which is easy to weld).

[0015] The sheathing object (hermetic container) 6 is the lamination bag of metallic foil 6a, such as aluminium foil, polyolefine (polypropylene etc.) film 6b of this inside, and insulating film 6c, such as a polyamide of a metallic foil outside, and polyester, and the inner surface has become polyolefine film 6b. Moreover, the acid denaturation polyolefines (acid denaturation polypropylene etc.) 9 are applied to the closure part with the sheathing object 6 of both sides of said terminals 7 and 8 for external connection. And said cell element assembly 10 with which the terminals 7 and 8 for external connection were welded is contained in the sheathing object 6 of the lamination bag which made polyolefine the inner surface, and is closed by heating and pressurizing opening (slash section of drawing 3) of the sheathing object 6 as a condition which drew the point of the terminals 7 and 8 for external connection outside (thermal melting arrival is carried out).

[0016] The acid denaturation polypropylene which is a kind of said acid denaturation polyolefine is sold from Mitsui Chemicals, Inc. as a trade name "a uni-urinal stall (liquefied polyolefine system adhesives)." Since acid denaturation polyolefine has a carboxyl group in a molecule, its adhesion is good to metals (aluminum, copper, iron, stainless steel, etc.), polyolefine, etc. Moreover, thermal resistance is also excellent. Spreading of the acid denaturation polyolefine 9 to said terminals 7 and 8 for external connection should just spray the dispersion which made toluene etc. distribute acid denaturation polyolefine by a spray etc. on the need part (closure part with a sheathing object) of the terminal concerned.

[0017] According to the gestalt of this operation, the inner surface of the sheathing object 6 is polyolefine, and by having arranged the acid denaturation polyolefine 9 between the polyolefine of a parenthesis, and the terminals 7 and 8 for external connection, since this is excellent in the adhesion to the sheathing object 6 and terminals 7 and 8, immobilization of terminals 7 and 8 can be made into the reinforcement which is equal to practical use enough, and improvement in tensile strength can be aimed at.

[0018]

EXAMPLE

[Example] Hereafter, the example of this invention is explained to a detail by the case where a sheet mold lithium ion rechargeable battery is constituted.

[0019] As acid denaturation polypropylene which is a kind of [example 1] acid denaturation polyolefine, Mitsui Chemicals, Inc. "the uni-urinal stall R-200" was used. The uni-urinal stall R-200 is the dispersion which made toluene distribute an acid denaturation polypropylene particle. The uni-urinal stall R-200 was applied to aluminium foil with **** of 4mm, a die length [of about 40mm], and a thickness of 0.1mm, and a nickel foil by the spray. It put into the 200-degree C dry warehouse for 10 minutes, and was made to stick to it after spreading. These foils serve as the terminals 7 and 8 for external connection.

[0020] As for the electrode, the positive electrode 1 created an active material LiCoO_2 , electric conduction assistant carbon black (HS-100, DENKI KAGAKU KOGYO make), and the thing which it becomes from Binder PVDF (polyvinylidene fluoride) with the doctor blade method. The negative electrode 2 created an active material meso carbon

micro bead (MCMB), electric conduction assistant HS-100, and the thing that consists of a binder PVDF with the doctor blade method. The separator 3 created PVDF and the thing which consists of SiO₂ with the doctor blade method. The positive electrode and the negative electrode were cut 31mm wide and in the shape of [41mm long] a rectangle. The separator was cut 33mm wide and in the shape of [43mm long] a rectangle. By 29mm wide like drawing 4 , and the shape of a 39mm long rectangle, further, it left charge collectors 4 and 5 (the ethylene acrylic-acid copolymer and the constituent of carbon black are applied to the EKUSUPANDO metal of the product made from aluminum, and copper) to tongue-shaped [with a width of face / of 7mm /, and a die length of 8mm], and they cut the terminal strapping part.

[0021] Creation of the cell element assembly 10 was performed as follows. The laminating of the separator 3 was first carried out to the positive electrode 1, and it laminated with a heat press. Lamination conditions are 130 degrees C and were pressurized for 2 minutes by pressure 3kgcm⁻². The laminating of the negative electrode was carried out to this, and it laminated similarly. The laminating of the charge collector 4 made from aluminum was carried out to the positive electrode of this, and it laminated similarly. In the negative electrode 2, the copper charge collector 5 was laminated similarly.

[0022] The terminal 8 made from nickel was welded by resistance to the terminal 7 made from aluminum, and the copper charge collector 5 at the charge collector 4 made from aluminum of this cell element assembly 10. LiPF₆ was immersed in the mixed solvent of the volume ratio 1:2 of EC (ethylene carbonate) and DMC (dimethyl carbonate) in this for 1 hour into 330ml of 1 electrolytic solutions in which it was made to dissolve M times. After picking out a cell element assembly from the electrolytic solution, the electrolytic solution adhering to an electrode surface was wiped off. This cell element assembly would absorb the electrolytic solution, and would be in the gel state. This cell element assembly was inserted in the sheathing object 6 (aluminium foil, a polypropylene film, and lamination bag with polyethylene terephthalate) which is inner surface polypropylene, opening was heat sealed (thermal melting arrival), and the sheet mold lithium ion rechargeable battery was produced. The cell of an example 1 using the terminal which applied acid denaturation polypropylene to the terminals 7 and 8 for external connection as acid denaturation polyolefine 9 was excellent in the tensile strength of the terminals 7 and 8 for external connection, as shown in the following table 1.

[0023]

table 1	A sample	A terminal	Tensile strength (kgf)	An example 1	Aluminum	3.1	***	***
3.2	***	3.0	**	Nickel	13.0	***	***	11.5***
10.2	An example 2	Aluminum	3.5	***	4.0	****	4.5	**
14.0	**	nickel	14.0	***	14.5	****	15.0	The example 1 of a comparison
Aluminum	1.3	***	1.7	***	1.0	**	nickel	1.4
2.3	***	1.7						

[0024] The sheet mold lithium ion rechargeable battery was produced like the example 1 except having used for the closure part with a sheathing object the terminals 7 and 8 for external connection which formed many small breakthroughs 11 like [example 2] drawing 6 . The sectional view was shown in drawing 5 , and the same sign was given to the same as that of an example 1, or a considerable part. The cell of an example 2 was excellent in tensile strength, as shown in said table 1. This reason is considered that the polypropylene of a sheathing inside-of-the-body side is from pile **** by the breakthrough 11 when thermal melting arrival of the sheathing object 6 and the terminals

7 and 8 for external connection is carried out.

[0025] The sheet mold lithium ion rechargeable battery was produced like the example 1 except having used the terminal for external connection which does not apply the [example 1 of comparison] acid denaturation polyolefine. As shown in said table 1, compared with the example 1, tensile strength is inferior in the cell of the example 1 of a comparison.

[0026] In addition, also in the case of sheet mold electrochemistry components, such as an electric duplex layer capacitor, this invention is applicable although the case where a cell was constituted as an electrode and the electrolyte structure was illustrated in the gestalt and example of the above-mentioned implementation. What is necessary is just to use a positive electrode and the polarizable electrode which used activated carbon etc. as active materials instead of the negative electrode in an electric duplex layer capacitor.

[0027] Moreover, acid denaturation polyolefine has some which are sold as liquefied polyolefine system adhesives by the trade name "SEPORUJON", "ZAIKUSEN", and a "CSM latex" from the trade name "the AKUA tex" and Sumitomo Seika Chemicals Co., Ltd. other than the trade name "a uni-urinal stall" of Mitsui Chemicals, Inc., and these activities are also more possible for it than CHUO RIKI KOGYO Corp.

[0028] Although the gestalt of operation of this invention has been explained above, probably, as for this invention, it will be obvious to this contractor for various kinds of deformation and modification to be possible within the limits of the publication of a claim, without being limited to this.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the gestalt (example 1) of operation of this invention, and is the important section expanded sectional view showing the case where a sheet mold lithium ion rechargeable battery is constituted.

[Drawing 2] It is the forward sectional view showing the whole gestalt (example 1) configuration of operation.

[Drawing 3] It is this top view.

[Drawing 4] It is the top view showing the charge collector used with the gestalt (example 1) of operation.

[Drawing 5] It is the important section expanded sectional view of the example 2 of this invention.

[Drawing 6] It is the top view of the terminal for external connection used in the example 2.

[Description of Notations]

1 Positive Electrode

2 Negative Electrode

3 Separator

4 Five Charge collector

6 Sheathing Object

7 Eight Terminal for external connection

9 Acid Denaturation Polyolefine

10 Cell Element Assembly
11 Breakthrough

DRAWINGS

[Drawing 1]

[Drawing 2]

[Drawing 3]

[Drawing 4]

[Drawing 5]

[Drawing 6]

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law

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[Procedure amendment]

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[Procedure amendment 1]

[Document to be Amended] Description

[Item(s) to be Amended] Claim

[Method of Amendment] Modification

[Proposed Amendment]

[Claim(s)]

[Claim 1] In the sheet mold electrochemistry component which comes to seal the electrode and the electrolyte structure which arranged the electrode on the both sides of a solid polymer electrolyte to the sheathing inside of the body,

The sheet mold electrochemistry component which the inner surface of said sheathing object is polyolefine, and the terminal for external connection linked to said electrode is aluminum or nickel, and is characterized by making acid denaturation polyolefine placed between closure parts with said sheathing object of both sides of said terminal for external connection.

[Claim 2] The sheet mold electrochemistry component according to claim 1 which the breakthrough is formed in the closure part with said sheathing object of both sides of said terminal for external connection, and comes to carry out said sheathing inside-of-the-body side and the terminal for external connection concerned thermal melting arrival in the part concerned.

[Claim 3] The sheet mold electrochemistry component according to claim 1 or 2 said whose terminal for external connection which said terminal for external connection connected to a positive electrode among said electrodes has connected to a negative electrode among aluminum and said electrode is nickel.

[Claim 4] The terminal for external connection of aluminum or nickel is connected to said electrode of the electrode and the electrolyte structure which arranged the electrode on the both sides of a solid polymer electrolyte. While acid denaturation polyolefine is made to be placed between closure parts with the sheathing object of both sides of this terminal for external connection and an inner surface encloses said electrode and electrolyte structure with the sheathing inside of the body of polyolefine The manufacture approach of the sheet mold electrochemistry component characterized by carrying out thermal melting arrival of said sheathing inside-of-the-body side and said terminal for external connection.

[Procedure amendment 2]

[Document to be Amended] Description

[Item(s) to be Amended] 0010

[Method of Amendment] Modification

[Proposed Amendment]

[0010]

[Means for Solving the Problem] in order it attain the above-mentioned object , the inner surface of said sheathing object be polyolefine , and the terminal for external connection linked to said electrode be aluminum or nickel , and characterize the sheet mold electrochemistry component of this invention by make acid denaturation polyolefine place between the closure parts by said sheathing object of both sides of said terminal for

external connection in the configuration a configuration close the electrode and the electrolyte structure which arrange an electrode on the both sides of a solid polymer electrolyte to the sheathing inside of the body .

[Procedure amendment 3]

[Document to be Amended] Description

[Item(s) to be Amended] 0011

[Method of Amendment] Modification

[Proposed Amendment]

[0011] In said sheet mold electrochemistry component, the breakthrough is formed in the closure part with said sheathing object of both sides of said terminal for external connection, and it is good also as a configuration which carries out thermal melting arrival of said sheathing inside-of-the-body side and the terminal for external connection concerned in the part concerned. Moreover, it is good in said terminal for external connection which said terminal for external connection connected to a positive electrode among said electrodes has connected to a negative electrode among aluminum and said electrode being nickel.

[Procedure amendment 4]

[Document to be Amended] Description

[Item(s) to be Amended] 0012

[Method of Amendment] Modification

[Proposed Amendment]

[0012] The manufacture approach of the sheet mold electrochemistry component of this invention The terminal for external connection of aluminum or nickel is connected to said electrode of the electrode and the electrolyte structure which arranged the electrode on the both sides of a solid polymer electrolyte. While acid denaturation polyolefine is made to be placed between closure parts with the sheathing object of both sides of this terminal for external connection and an inner surface encloses said electrode and electrolyte structure with the sheathing inside of the body of polyolefine, it is characterized by carrying out thermal melting arrival of said sheathing inside-of-the-body side and said terminal for external connection.

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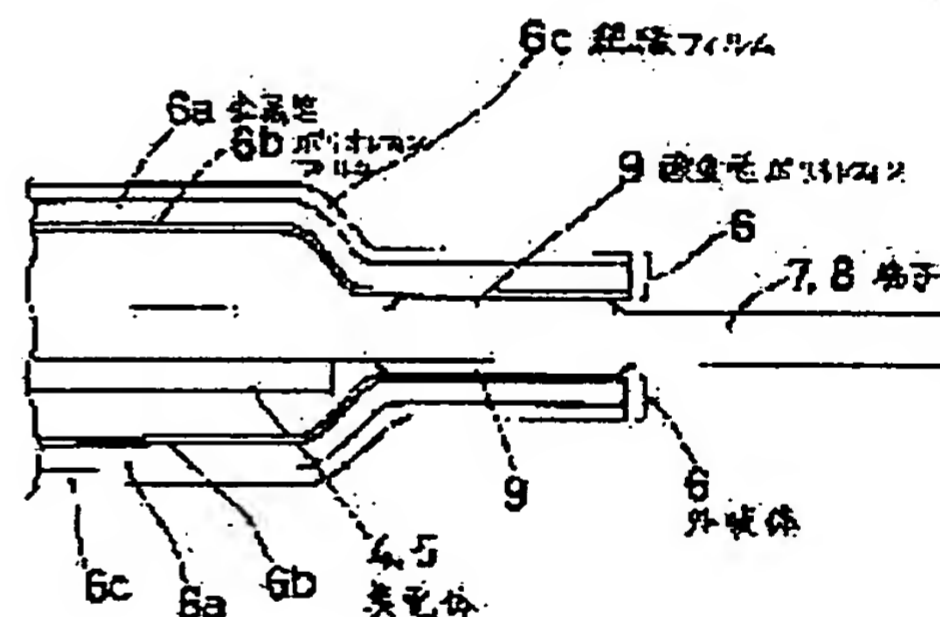
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(54) SHEET TYPE ELECTROCHEMICAL ELEMENT AND ITS MANUFACTURE

(57)Abstract:

PROBLEM TO BE SOLVED: To enhance the strength at which the external connection terminals of a sheet type electrochemical element such as a lithium ion battery are secured to a sheath.

SOLUTION: This electrochemical element includes a structure whereby an electrode-electrolyte structure having electrodes placed on both sides of a polymer solid electrolyte is sealed in a sheath 6, and the inner surface of the sheath 6 is formed of a polyolefin film 6b. Each side of each external connection terminal 7, 8 connected to the electrodes has an acid-denatured polyolefin 9 applied to its portion sealed by the sheath, and the sealed portion is heat sealed.



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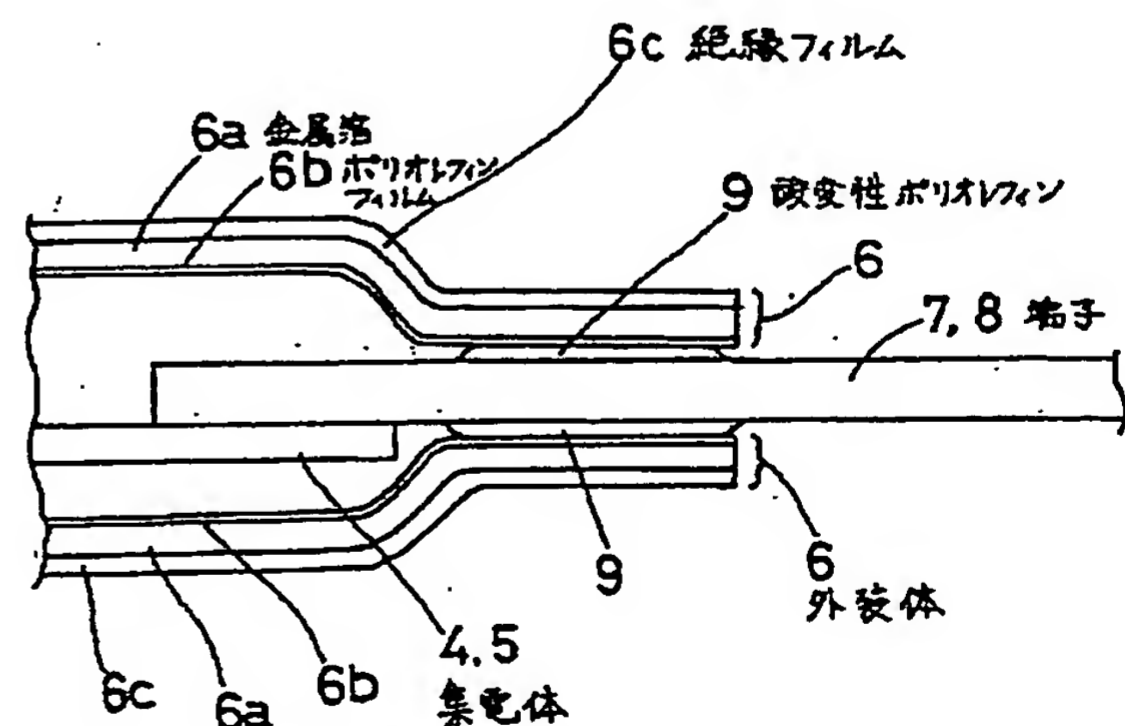
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(54)【発明の名称】 シート型電気化学素子及びその製造方法

(57)【要約】

【課題】 リチウムイオン電池等のシート型電気化学素子における外部接続用端子の外装体に対する固着強度の向上を図る。

【解決手段】 高分子固体電解質の両側に電極を配した電極・電解質構造体を外装体6内に密封する構造を具備し、前記外装体6の内面をポリオレフィンフィルム6bとし、前記電極に接続している外部接続用端子7, 8の両面の前記外装体による封止部分に酸変性ポリオレフィン9を塗布し、当該封止部分をヒートシールしている。



【特許請求の範囲】

【請求項1】 高分子固体電解質の両側に電極を配した電極・電解質構造体を外装体内に密封してなるシート型電気化学素子において、

前記外装体の内面がポリオレフィンであり、前記電極に接続している外部接続用端子の両面の前記外装体による封止部分に酸変性ポリオレフィンが塗布されていることを特徴とするシート型電気化学素子。

【請求項2】 前記外部接続用端子の両面の前記外装体による封止部分に貫通孔が形成されており、当該部分において前記外装体内面と当該外部接続用端子とを熱融着してなる請求項1記載のシート型電気化学素子。

【請求項3】 高分子固体電解質の両側に電極を配した電極・電解質構造体の前記電極に外部接続用端子を接続し、該外部接続用端子の両面の外装体による封止部分に酸変性ポリオレフィンを塗布しておき、前記電極・電解質構造体を、内面がポリオレフィンの外装体内に封入するとともに、前記外装体内面と前記外部接続用端子とを熱融着したことを特徴とするシート型電気化学素子の製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、シート型電池、電気2重層キャパシタ等のシート型電気化学素子及びその製造方法に係り、とくに外部接続用端子及びその周辺部分の構成を工夫したシート型電気化学素子及びその製造方法に関するものである。

【0002】

【従来の技術】近年、リチウムイオン2次電池と称される負極活物質に炭素材料、酸化すず、酸化ケイ素等を用いた2次電池が各種エレクトロニクス製品、電気自動車に使用又は使用が検討されている。これらのリチウムイオン2次電池は、液体の溶媒に電解質塩を溶解させたいわゆる電解液を用いている。電解液を用いた電池は、内部抵抗が低いという長所があるが、反面、液漏れがしやすい、発火する危険性があるという問題点がある。このような問題点に対し、例えば、高分子、電解質塩及び溶媒からなるゲル状の高分子固体電解質が近年脚光を浴びている。このようなゲル状の高分子固体電解質は、導電率が液体のそれに近く $10^{-3} \text{ S} \cdot \text{cm}^{-1}$ 台の値を示すものもある。

【0003】高分子固体電解質を用いた電池は、液体の電解質を用いていないため液漏れがしにくい。従って、液体の電解液を用いた従来の電池のように金属製容器とその間にある高分子製のパッキンで機械的にかしめる必要はない。高分子固体電解質電池は高分子フィルムと金属箔とからなるラミネートフィルムを外装（容器）とする程度で液漏れは防止できる。

【0004】

【発明が解決しようとする課題】しかしながら、外装と

してのラミネートフィルムを形成している高分子の種類によっては、電池の電極に接続した外部接続用端子とラミネートフィルムとの密着性が不十分で外部接続用端子の固定が十分でなかった。

【0005】なお、高分子固体電解質を用いた電気2重層キャパシタ等においてもラミネートフィルムを外装として用いることができるが、同様の問題が発生する。

【0006】上記の欠点を改良するために、本発明者らは、種々の高分子を検討した結果、この種の高分子固体電解質を用いた電池、電気2重層キャパシタ等のシート型電気化学素子の外装体として用いることができるラミネートフィルムの内面がポリオレフィンであり、酸変性ポリオレフィンが塗布されている外部接続用端子を用いたシート型電気化学素子が、ラミネートフィルムと外部接続用端子との密着性に優れるため外部接続用端子の固定強度が十分大きいことを見いだした。

【0007】なお、特開平8-287889号では、外装体として、ラミネートフィルムの他、2層の樹脂フィルムを用いるものが提案されているが、外部接続用端子の固着強度を改善するものではない。

【0008】本発明は、上記の点に鑑み、外部接続用端子の外装体に対する固着強度の向上を図ったシート型電気化学素子及びその製造方法を提供することを目的とする。

【0009】本発明のその他の目的や新規な特徴は後述の実施の形態において明らかにする。

【0010】

【課題を解決するための手段】上記目的を達成するために、本発明のシート型電気化学素子は、高分子固体電解質の両側に電極を配した電極・電解質構造体を外装体内に封止した構成において、前記外装体の内面がポリオレフィンであり、前記電極に接続している外部接続用端子の両面の前記外装体による封止部分に酸変性ポリオレフィンが塗布されていることを特徴している。

【0011】前記シート型電気化学素子において、前記外部接続用端子の両面の前記外装体による封止部分に貫通孔が形成されており、当該部分において前記外装体内面と当該外部接続用端子とを熱融着する構成としてもよい。

【0012】本発明のシート型電気化学素子の製造方法は、高分子固体電解質の両側に電極を配した電極・電解質構造体の前記電極に外部接続用端子を接続し、該外部接続用端子の両面の外装体による封止部分に酸変性ポリオレフィンを塗布しておき、前記電極・電解質構造体を、内面がポリオレフィンの外装体内に封入するとともに、前記外装体内面と前記外部接続用端子とを熱融着したことを特徴としている。

【0013】

【発明の実施の形態】以下、本発明に係るシート型電気化学素子及びその製造方法の実施の形態を図面に従って

説明する。

【0014】図1乃至図4で本発明の実施の形態を説明する。図1は電気化学素子としてのシート型リチウムイオン2次電池の要部拡大断面図、図2はシート型リチウムイオン2次電池の全体構成の正断面図であり、A部を拡大したものが図1である。図3は同平面図、図4は集電体の平面図である。これらの図において、1は正極、2は負極、3は正、負極間に介在する高分子固体電解質のセパレータであり、正極1にはアルミニウム製集電体4が、負極2には銅製集電体5がそれぞれ積層一体化されて、電池素体10（電極・電解質構造体）を構成している。図4に示すように集電体4、5は外部接続用端子7、8を接続するために舌片部4a、5aを持ち、ここに外部接続用端子7、8がそれぞれ溶接されている。集電体4とこれに溶接される外部接続用端子7とが同じ金属材料（又は溶接しやすい材質）で、同様に集電体5と外部接続用端子8とが同じ金属材料（又は溶接しやすい材質）であることが好ましい。

【0015】外装体（密封容器）6は、アルミニウム箔等の金属箔6aとこの内側のポリオレフィン（ポリプロピレン等）フィルム6bと金属箔外側のポリアミド、ポリエステル等の絶縁フィルム6cとのラミネート袋であり、内面がポリオレフィンフィルム6bとなっている。また、前記外部接続用端子7、8の両面の外装体6による封止部分に酸変性ポリオレフィン（酸変性ポリプロピレン等）9が塗布されている。そして、外部接続用端子7、8が溶接された前記電池素体10は、ポリオレフィンを内面としたラミネート袋の外装体6内に収納され、外部接続用端子7、8の先端部を外部に導出した状態として外装体6の開口部（図3の斜線部）を加熱、加圧することで封止される（熱融着される）。

【0016】前記酸変性ポリオレフィンの一種である酸変性ポリプロピレンは三井化学（株）より商品名「ユニストール（液状ポリオレフィン系接着剤）」として販売されている。酸変性ポリオレフィンは分子中にカルボキシル基があるため、金属（アルミニウム、銅、鉄、ステンレス等）、ポリオレフィン等に対し密着性が良い。また、耐熱性も優れている。前記外部接続用端子7、8への酸変性ポリオレフィン9の塗布は、酸変性ポリオレフィンをトルエン等に分散させたディスパージョンを当該端子の必要部分（外装体による封止部分）にスプレー等で吹き付ければよい。

【0017】この実施の形態によれば、外装体6の内面がポリオレフィンでありかつこのポリオレフィンと外部接続用端子7、8との間に酸変性ポリオレフィン9を配置したことで、これが外装体6と端子7、8への密着性に優れるため端子7、8の固定を十分実用に耐える強度とすることができ、引っ張り強度の向上を図ることができる。

【0018】

【実施例】以下、本発明の実施例をシート型リチウムイオン2次電池を構成した場合で詳細に説明する。

【0019】【実施例1】酸変性ポリオレフィンの一種である酸変性ポリプロピレンとして、三井化学（株）

「ユニストールR-200」を用いた。ユニストールR-200は酸変性ポリプロピレン微粒子をトルエンに分散させたディスパージョンである。ユニストールR-200を幅約4mm、長さ約40mm、厚み0.1mmのアルミニウム箔及びニッケル箔に、スプレーで塗布した。塗布後に200℃の乾燥庫に10分間入れ密着させた。これらの箔が外部接続用端子7、8となる。

【0020】電極は、正極1が活物質 LiCoO_2 、導電助剤カーボンブラック（HS-100、電気化学工業製）、結着剤PVDF（ポリふっ化ビニリデン）からなるものをドクターブレード法で作成した。負極2は、活物質メソカーボンマイクロビーズ（MCMB）、導電助剤HS-100、結着剤PVDFからなるものをドクターブレード法で作成した。セパレータ3は、PVDF、 SiO_2 からなるものをドクターブレード法で作成した。正極、負極は、横31mm、縦41mmの長形状に切断した。セパレータは横33mm、縦43mmの長形状に切断した。集電体4、5（エチレンアクリル酸共重合体とカーボンブラックの組成物が、アルミニウム製及び銅製のエキスパンドメタルに塗布されている）は、図4の如き横29mm、縦39mmの長形状でさらに端子接続部分を幅7mm、長さ8mmの舌片状に残して切断した。

【0021】電池素体10の作成は次のように行った。まず正極1とセパレータ3を積層し熱プレスでラミネートした。ラミネート条件は130℃で、圧力3kg/cm²で2分間加圧した。これに負極を積層し同様にラミネートした。これの正極にアルミニウム製集電体4を積層し同様にラミネートした。負極2には銅製集電体5を同様にラミネートした。

【0022】この電池素体10のアルミニウム製集電体4にはアルミニウム製端子7、銅製集電体5にはニッケル製端子8を抵抗溶接した。これをEC（エチレンカーボネート）とDMC（ジメチルカーボネート）の体積比1：2の混合溶媒に LiPF_6 を1M溶解させた電解液330ml中に1時間浸漬した。電解液から電池素体を取り出したあと電極表面に付着している電解液を拭き取った。この電池素体は電解液を吸収しゲル状態となった。この電池素体を内面ポリプロピレンである外装体6（アルミニウム箔とポリプロピレンフィルム及びポリエチレンテレフタレートとのラミネート袋）に挿入し、開口部をヒートシール（熱融着）し、シート型リチウムイオン2次電池を作製した。酸変性ポリオレフィン9として酸変性ポリプロピレンを外部接続用端子7、8に塗布した端子を用いた実施例1の電池は、以下の表1に示すように外部接続用端子7、8の引っ張り強度が優れていた。

【0023】

表1		
サンプル	端子	引っ張り強度 (kgf)
実施例1	アルミニウム	3.1
"	"	3.2
"	"	3.0
"	ニッケル	13.0
"	"	11.5
"	"	10.2
実施例2	アルミニウム	3.5
"	"	4.0
"	"	4.5
"	ニッケル	14.0
"	"	14.5
"	"	15.0
比較例1	アルミニウム	1.3
"	"	1.7
"	"	1.0
"	ニッケル	1.4
"	"	2.3
"	"	1.7

【0024】【実施例2】図6のように外装体による封止部分に小さな貫通孔11を多数設けた外部接続用端子7, 8を用いた以外は、実施例1と同様にしてシート型リチウムイオン2次電池を作製した。その断面図を図5に示し、実施例1と同一又は相当部分に同一符号を付した。実施例2の電池は、前記表1のように引っ張り強度が優れていた。この理由は、外装体6と外部接続用端子7, 8とを熱融着したときに、貫通孔11に外装体内面のポリプロピレンがくい込むからであると考えられる。

【0025】【比較例1】酸変性ポリオレフィンを塗布しない外部接続用端子を使用した以外は、実施例1と同様にしてシート型リチウムイオン2次電池を作製した。前記表1に示すように比較例1の電池は実施例1に比べ引っ張り強度が劣っている。

【0026】なお、上記実施の形態及び実施例では、電極・電解質構造体として電池を構成した場合を例示したが、電気2重層キャパシタ等のシート型電気化学素子の場合にも本発明は適用できる。電気2重層キャパシタでは、正極、負極の代わりに活物質として活性炭等を用いた分極性電極を用いればよい。

【0027】また、酸変性ポリオレフィンは、三井化学(株)の商品名「ユニストール」の他に、中央理化学工業(株)より商品名「アクアテックス」、住友精化(株)より商品名「セボルジョン」「ザイクセン」「CSMラテックス」で液状ポリオレフィン系接着剤として販売されているものがあり、これらの使用も可能である。

【0028】以上本発明の実施の形態について説明してきたが、本発明はこれに限定されることなく請求項の記載の範囲内において各種の変形、変更が可能なことは当

業者には自明であろう。

【0029】

【発明の効果】以上説明したように、本発明によれば、外装体の内面がポリオレフィンでありかつこのポリオレフィンと外部接続用端子との間に酸変性ポリオレフィンが介在するように外部接続用端子に酸変性ポリオレフィンを塗布したことで、外装体と外部接続用端子との密着性を改善し、外部接続用端子の固着強度の向上を図ることができ、外部接続用端子の固定が十分実用に耐える強度となる。

【0030】また、前記外部接続用端子の一部に貫通孔を設けておき、該貫通孔の部分で外装体と外部接続用端子とを熱融着する構成とすれば、貫通孔に外装体内面のポリオレフィンがくい込みさらに外部接続用端子の固着強度が向上する。

【図面の簡単な説明】

【図1】本発明の実施の形態(実施例1)であってシート型リチウムイオン2次電池を構成した場合を示す要部拡大断面図である。

【図2】実施の形態(実施例1)の全体構成を示す正断面図である。

【図3】同平面図である。

【図4】実施の形態(実施例1)で用いる集電体を示す平面図である。

【図5】本発明の実施例2の要部拡大断面図である。

【図6】実施例2で用いる外部接続用端子の平面図である。

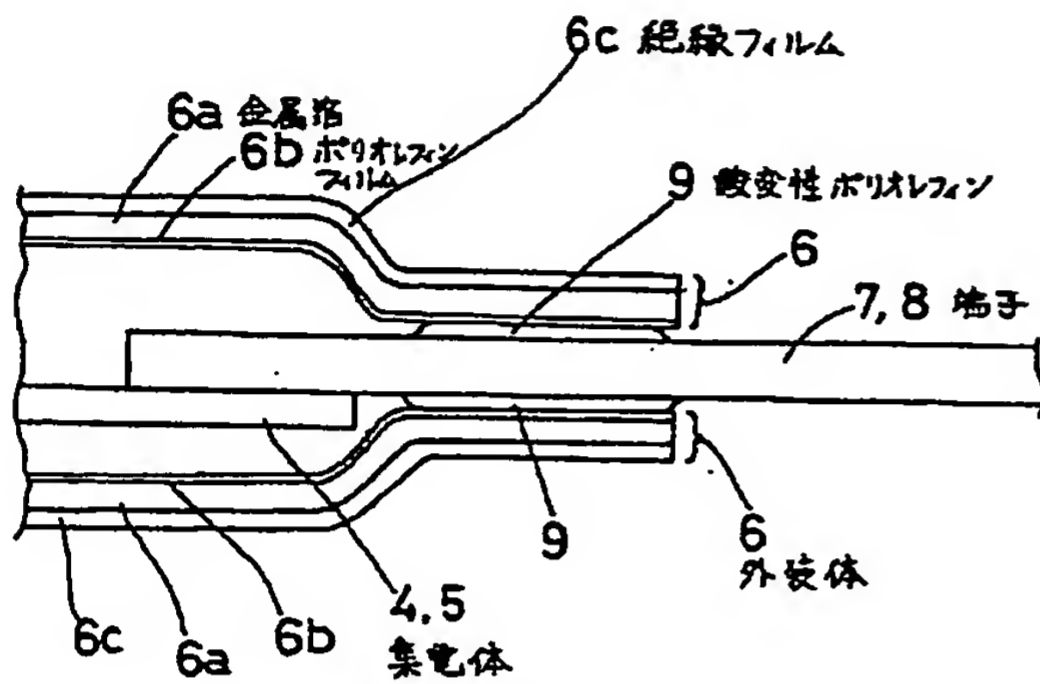
【符号の説明】

1 正極

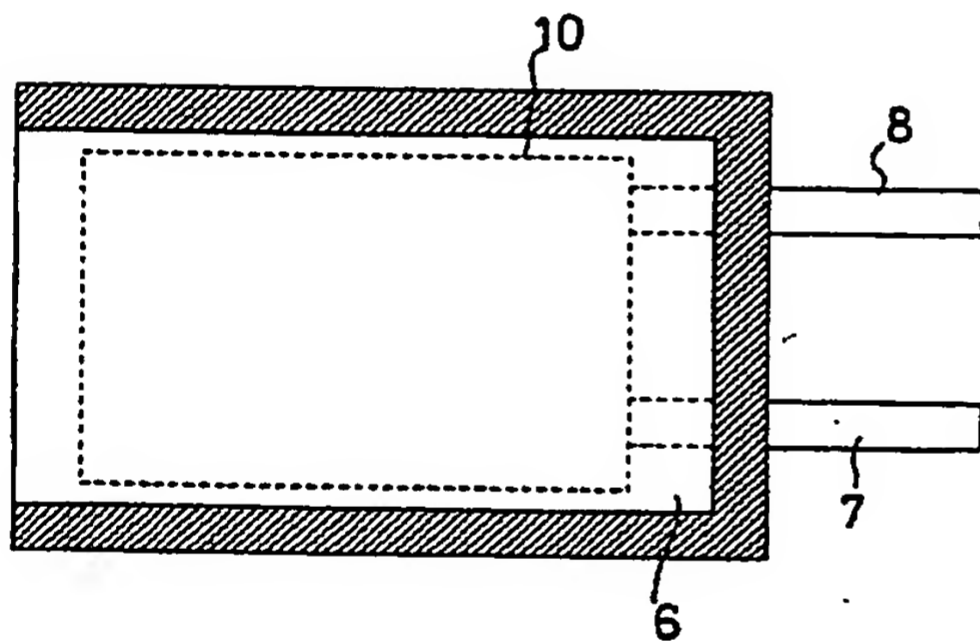
7

- 2 負極
3 セパレータ
4, 5 集電体
6 外装体

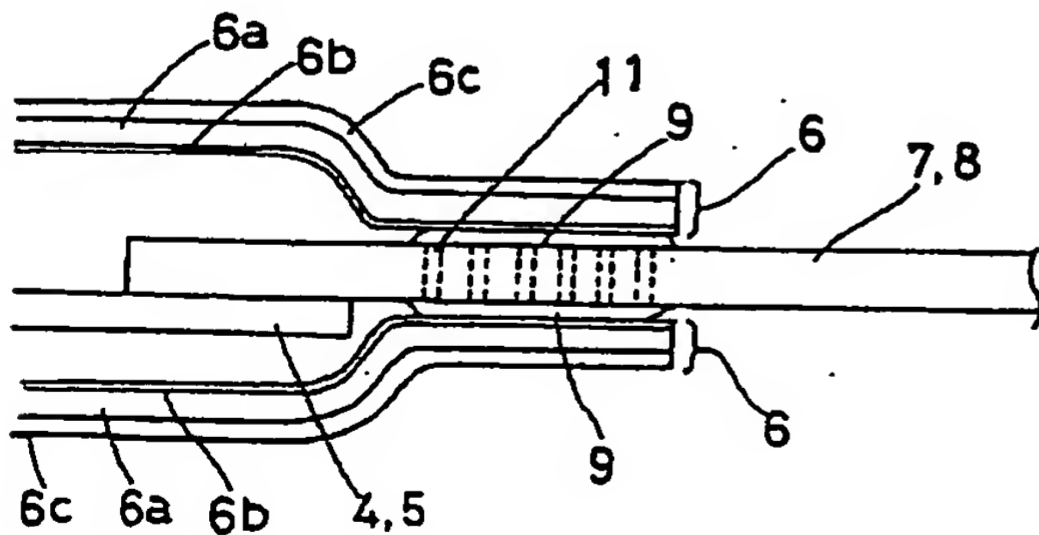
【図1】



【図3】



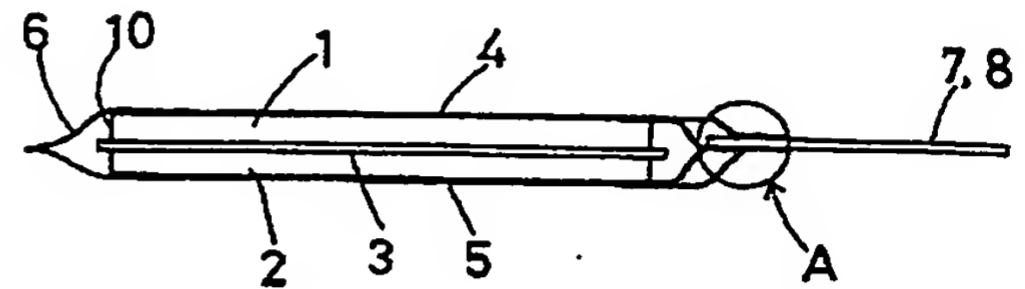
【図5】



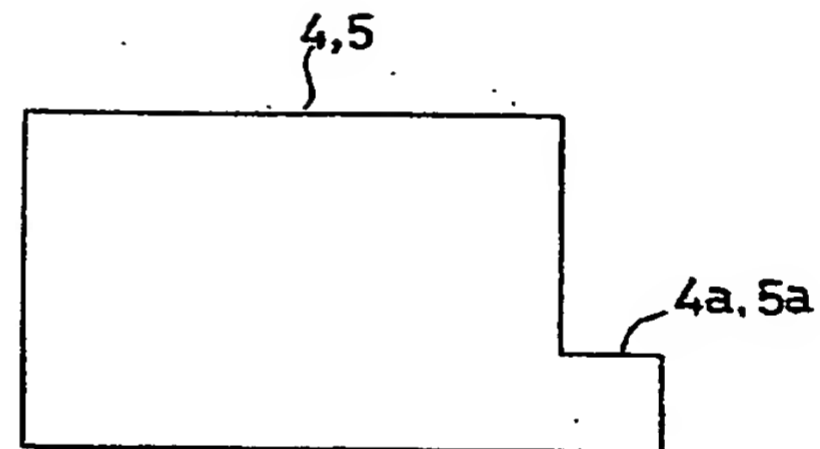
8

- 7, 8 外部接続用端子
9 酸変性ポリオレフィン
10 電池素体
11 貫通孔

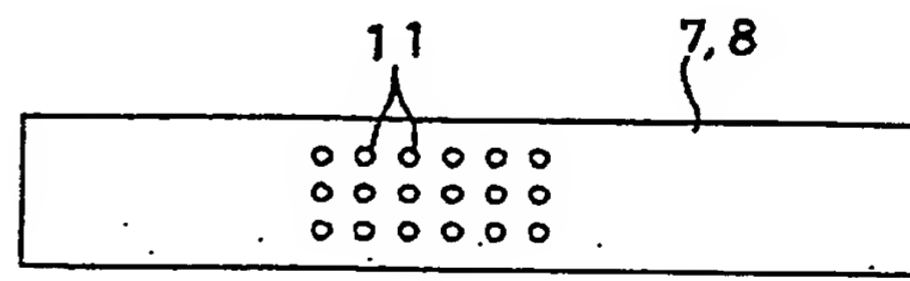
【図2】



【図4】



【図6】



フロントページの続き

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